Amendments to the Claims

This listing will replace all prior versions and listings of claims in the application:

Listing of Claims

1. (Currently amended) A method of preparing a multi-domain liquid-crystal display, ~~which is operable in the in-plane switching mode,~~ comprising the steps of:

depositing a dry deposit alignment layer on a substrate;

partitioning said dry deposited layer into a plurality of domain areas; and

aligning said dry deposited layer using a method selected from the group consisting of: mechanical mask, photo-resist, UV treatment, and ridge and fringe field,

wherein said alignment is achieved by exposing said dry deposited layer to at least a first particle beam and a second particle beam, ~~and~~

wherein a direction of said first particle beam with respect to said dry deposited layer is different than a direction of said second particle beam with respect to said dry deposited layer, and

wherein said liquid-crystal display is operable in the in-plane switching mode.

2-3. (Cancelled)

4. (Withdrawn) The method of claim 1, wherein said photo-resist method comprises:

depositing on a transparent conductive layer on a substrate a material to form said dry deposited layers;

partitioning said dry deposited layers into first domain areas and second domain areas of the dry deposited layers;

bombarding said dry depositing layers with a first ion beam; thereafter

covering said first domain areas of said dry deposited layers with a mask leaving said second domain areas open;

bombarding said second domain areas with a second ion beam; and

removing said mask.

5. (Withdrawn) The method of claim 4, wherein said step of partitioning comprises the step of covering only said first domain areas with a mask.

6. (Withdrawn) The method of claim 5, wherein said step of covering comprises the step of applying a layer of photo-resist.

7. (Withdrawn) The method of claim 1, wherein said UV treatment method comprises:

depositing on a transparent conductive layer on a substrate a material to form a dry deposited layer;

partitioning said dry deposited layer into first domain areas and second domain areas of the dry deposited layer;

selectively exposing one of said first and said second domain areas to UV light; and

bombarding both said first and said second domain areas with an ion beam in a single direction to produce in non-UV exposed domain areas a pretilt angle different from the areas that were exposed to UV light.

8. (Withdrawn) The method of claim 1, wherein said ridge and fringe field method comprises:

providing a top substrate having a surface;

providing a color filter on said top substrate;

providing a transparent conductive layer disposed over said color filter;

building a polymer ridge on said transparent conductive layer on the color filter side;

depositing on said surface of said transparent conductive layer and said ridge a material to form a dry deposited alignment layer; and

bombarding said dry deposited layer with an ion beam under conditions to produce a low pretilt angle.

9. (Previously presented) A multi-domain, wide viewing angle liquid-crystal display, comprising:

a bottom substrate having a first surface;

a first transparent conductive layer disposed over said first surface of said bottom substrate;

a top substrate having a second surface;

a color filter layer disposed over said second surface of said top substrate;

a second transparent conductive layer disposed over said color filter;

a first dry deposited layer over said first transparent conductive layer;

a second dry deposited layer over said second transparent conductive layer; said second dry deposited layer being spaced adjacent to and facing said first dry deposited layer;

a plurality of uniformly sized transparent or non-transparent spacers distributed within said space; and

a liquid-crystal material disposed in the space therebetween;

wherein each of said first dry deposited layer and said second dry deposited layer is divided into a plurality of pixels each having a boundary and at least two domains; wherein each of said multi-domain, dry deposited layers is obtained by a method selected from the group consisting of: mechanical mask, photo-resist, UV treatment, and ridge and fringe field methods;

wherein said dry deposited layers are exposed to at least a first particle beam and a second particle beam;

wherein a direction of said first particle beam with respect to said dry deposited layers is different than a direction of said second particle beam with respect to said dry deposited layers; and

wherein said liquid-crystal display is operable in the in-plane switching mode.

10. (Cancelled)

11. (Previously presented) The multi-domain, wide viewing angle liquid-crystal display of claim 40, wherein said mechanical mask method comprises:

depositing a material on a substrate to form a transparent dry deposited layer;

bombarding said dry deposited layer with said first particle beam;

masking said dry deposited layer into first domain areas and second domain areas of the dry deposited layer with a mask; and

selectively bombarding said dry deposited layer with said second particle beam through said mask.

12. (Original) The multi-domain, wide viewing angle liquid-crystal display of claim 11, wherein said material is selected from the group consisting of: hydrogenated diamond-like carbon, amorphous hydrogenated silicon, silicon carbide (SiC), silicon dioxide (SiO_2), glass, silicon nitride (Si_3N_4), alumina (Al_2O_3), cerium(IV) oxide (CeO_2), tin oxide (SnO_2), zinc titanate ($ZnTiO_2$) and a combination thereof.

13. (Previously presented) The multi-domain, wide viewing angle liquid-crystal display of claim 11, wherein said first particle beam and said second particle beam is provided from a source of an ion beam selected from the group consisting of: argon, nitrogen, oxygen, and a mixture thereof.

14. (Withdrawn) The multi-domain, wide viewing angle liquid-crystal display of claim 9, wherein each of said pixels have a first domain and a second domain.

15. (Withdrawn) The multi-domain, wide viewing angle liquid-crystal display of claim 14, wherein said first domain and second domain have a different ion bombardment direction.

16. (Withdrawn) The multi-domain, wide viewing angle liquid-crystal display of claim 15, wherein both of said first and said second dry deposited layers on said bottom and said top substrates have been bombarded.

17. (Withdrawn) The multi-domain, wide viewing angle liquid-crystal display of claim 9, wherein said liquid-crystal material is selected from the group consisting of a liquid-crystal having left-handed chirality, a liquid-crystal having right-handed chirality, and a liquid-crystal having no chirality.

18. (Withdrawn) The multi-domain, wide viewing angle liquid-crystal display of claim 9, wherein said domains of said first and said second dry deposited layers are obtained by photo-resist method.

19. (Withdrawn) The multi-domain, wide viewing angle liquid-crystal display of claim 18, wherein each of said pixels have a first domain and a second domain.

20. (Withdrawn) The multi-domain, wide viewing angle liquid-crystal display of claim 18, wherein said photo-resist method comprises:

depositing on a transparent conductive layer on a substrate a material to form a dry deposited layer;

partitioning said dry deposited layer into first domain areas and second domain areas of the dry deposited layer;

bombarding said dry deposited layer with a first ion beam; thereafter

covering said first domain areas of said dry deposited layer with a mask leaving said second domain areas open;

bombarding said second domain areas with a second ion beam; and

removing said mask.

21. (Cancelled)

22. (Withdrawn) The multi-domain, wide viewing angle liquid-crystal display of claim 9, wherein said domains of said first and said second dry deposited layers are obtained by said UV treatment method.

23. (Withdrawn) The multi-domain, wide viewing angle liquid-crystal display of claim 22, wherein each of said pixels have a first domain and a second domain.

24. (Withdrawn) The multi-domain, wide viewing angle liquid-crystal display of claim 22, wherein said UV treatment method comprises:

depositing on a transparent conductive layer on a substrate a material to form a dry deposited layer;

partitioning said dry deposited layer into first domain areas and second domain areas of the dry deposited layer;

selectively exposing one of said first and said second domain areas to UV light; and

bombarding both said first and said second domain areas with an ion beam in a single direction to produce in said non-UV exposed domain areas a pretilt angle different from the areas that were exposed to UV light.

25. (Withdrawn) The multi-domain, wide viewing angle liquid-crystal display of claim 22, wherein said UV treatment method comprises:

depositing on a transparent conductive layer on a substrate a material to form a dry deposited layer;

partitioning said dry deposited layer into first domain areas and second domain areas of the dry deposited layer;

selectively bombarding one of said first and said second domain areas with an ion beam in a single direction; and

exposing both said first and said second domain areas to UV light to produce in said non-bombarded domain areas a pretilt angle different from the areas that were bombarded with an ion beam.

26. (Withdrawn) The multi-domain, wide viewing angle liquid-crystal display of claim 9, wherein said domains of said first and said second dry deposited layers are obtained by said ridge and fringe field method.

27. (Withdrawn) The multi-domain, wide viewing angle liquid-crystal display of claim 26, wherein said ridge and fringe field method comprises:

building a polymer ridge on said transparent conductive layer on the color filter side;

depositing on said surface of said transparent conductive layer a material to form a dry deposited layer; and

bombarding said dry deposited layer with an ion beam under conditions to produce a low pretilt angle.

28. (Withdrawn) The multi-domain, wide viewing angle liquid-crystal display of claim 27, wherein said transparent conductive layer comprises indium tin oxide.

29. (Withdrawn) An improved method of preparing a liquid-crystal display of the type having the steps of forming a first dry deposited layer, forming a second dry deposited layer, spacing the first dry deposited layer and the second dry deposited layer adjacent to and facing each other and filling a liquid-crystal material in the space therebetween, wherein the improvement comprises the steps of:

forming a first multi-domain dry deposited layer;

forming a second multi-domain dry deposited layer;

spacing said first multi-domain dry deposited layer and said second multi-domain dry deposited layer adjacent to and facing each other; and

filling a liquid-crystal material in the space therebetween;

wherein each of said multi-domain, dry deposited layers is obtained by a method selected from the group consisting of: mechanical mask, photo-resist, UV treatment, and ridge and fringe field, and

wherein said liquid-crystal display is operable in the in-plane switching mode.

30. (Withdrawn) An improved method of preparing an in-plane switching mode liquid-crystal display of the type having the steps of forming a first polyamide alignment layer and a second polyamide alignment layer, wherein each of the first and second layers is rubbed with a mechanical roll wrapped in a velvet cloth, wherein the improvement comprises the steps of:

forming a first dry deposited alignment layer;

forming a second dry deposited layer;

spacing said first dry deposited layer and said second dry deposited layer adjacent to and facing each other; and

filling a liquid-crystal material in the space therebetween;

wherein each of said dry deposited layers is obtained by a method selected from the group consisting of: mechanical mask, photo-resist, UV treatment, and ridge and fringe field;

wherein said dry deposited layer is exposed to a particle beam;

wherein said particle beam is directed at said dry deposited layer at an adjustable angle with respect to said dry deposited liquid-crystal alignment layer, and

wherein said liquid-crystal display is operable in the in-plane switching mode.

31. (Withdrawn) A wide viewing angle in-plane switching mode liquid-crystal display, comprising:

a bottom polarizer;

a bottom substrate;

a top polarizer;

a top substrate;

a color filter layer disposed over a surface of said top substrate;

a plurality of common electrodes disposed in the bottom substrate plane and a plurality of pixel electrodes disposed in a staggering relationship therewith to form a comb-like structure for producing an electric field parallel to plane of said bottom substrate so that when operated, the molecules of said liquid-crystal material are switched to rotate by said vertical electric field in a direction parallel to the substrate surface;

a first dry deposited layer over said bottom substrate and said comb-like electrodes;

a second dry deposited layer over said color filter layer; said second dry deposited layer being spaced adjacent to and facing said first dry deposited layer;

a plurality of uniformly sized transparent or non-transparent spacers spacers distributed within said space; and

a liquid-crystal material disposed in the space therebetween;

wherein said dry deposited layer is exposed to a particle beam;

wherein said particle beam is directed at said dry deposited layer at an adjustable angle with respect to said dry deposited layer,

wherein said dry deposited layers are aligned by a method selected from the group consisting of: mechanical mask, photo-resist, UV treatment, and ridge and fringe field, and

wherein said liquid-crystal display is operable in the in-plane switching mode.

32. (Withdrawn) The liquid-crystal display of claim 31, wherein said method of obtaining each of said dry deposited layers comprises: treating a dry deposited layer with an ion beam in a direction making from about 10 to about 20 degree angle with the plane of the electrodes.

33. (Withdrawn) The liquid-crystal display of claim 31, wherein each of said common electrodes on one end is in communication with a storage capacitor, wherein each of said pixel electrodes is in communication on one end with said storage capacitor and on the other end with a thin film transistor, said thin film transistor being in communication with a data bus line and a gate bus line.

34-36. (Cancelled)

37. (Previously presented) A multi-domain, wide viewing angle liquid-crystal display, comprising:

a bottom substrate having a first surface;

a first transparent conductive layer disposed over said first surface of said bottom substrate;

a top substrate having a second surface;

a color filter layer disposed over said second surface of said top substrate;

a second transparent conductive layer disposed over said color filter;

a first dry deposited layer over said first transparent conductive layer;

a second dry deposited layer over said second transparent conductive layer; said second dry deposited layer being spaced adjacent to and facing said first dry deposited layer;

a plurality of uniformly sized transparent or non-transparent spacers distributed within said space; and

a liquid-crystal material disposed in the space therebetween;

wherein each of said first dry deposited layer and said second dry deposited layer is divided into a plurality of pixels each having a boundary and at least two domains; wherein each of said multi-domain, dry deposited layers is obtained by a method selected from the group consisting of: mechanical mask, photo-resist, UV treatment, and ridge and fringe field methods;

wherein said dry deposited layers are exposed to at least a first particle beam and a second particle beam;

wherein a direction of said first particle beam with respect to said dry deposited layers is different than a direction of said second particle beam with respect to said dry deposited layer;

wherein said multi-domain, liquid-crystal display is operable in the in-plane switching mode; and

wherein said multi-domain, liquid-crystal display has a wide viewing angle.

38. (Previously presented) The method of claim 1, wherein said mechanical mask method comprises:

depositing a material on a transparent conductive layer on a substrate to form a dry deposited layer;

bombarding said dry deposited layer with said first particle beam;

partitioning said dry deposited layer into first domain areas and second domain areas of the dry deposited layer;

masking one or more domains with a mask; and

selectively bombarding said dry deposited layer with said second particle beam through said mask.

39. (Previously presented) The method of claim 38, wherein said material is selected from the group consisting of: diamond-like carbon, silicon oxide and a combination thereof.

40. (Previously presented) The multi-domain, wide viewing angle liquid-crystal display of claim 9, wherein said domains of said first and said second dry deposited layers are obtained by said mechanical mask method.